NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

DIVERSION
(feet)
CODE 362

DEFINITION

A channel constructed across the slope generally with a supporting ridge on the lower side.

PURPOSE

This practice may be applied as part of a resource management system to support one or more of the following purposes.

- Break up concentrations of water on long slopes, on undulating land surfaces, and on land that is generally considered too flat or irregular for terracing.
- Divert water away from farmsteads, agricultural waste systems, and other improvements.
- Collect or direct water for water-spreading or water-harvesting systems.
- Increase or decrease the drainage area above ponds.
- Protect terrace systems by diverting water from the top terrace where topography, land use, or land ownership prevents terracing the land above.
- Intercept surface and shallow subsurface flow.
- Reduce runoff damages from upland runoff.
- Reduce erosion and runoff on urban or developing areas and at construction or mining sites.
- Divert water away from active gullies or critically eroding areas.
- Supplement water management on conservation cropping or stripcropping systems.

CONDITIONS WHERE PRACTICE APPLIES

This applies to all cropland and other land uses where surface runoff water control and or management is needed. It also applies where soils and topography are such that the diversion can be constructed and a suitable outlet is available or can be provided.

Diversions shall not be substituted for terraces on land requiring terracing for erosion control.

The State Conservation Engineer shall be notified if there is a threat to loss of life or high property value, before the start of planning or design.

CRITERIA

Capacity

Diversions as temporary measures, with an expected life span of less than 2 years, shall have a minimum capacity for the peak discharge from the 2-year frequency, 24-hour duration storm.

Diversions that protect agricultural land *and* shall have a minimum capacity for the peak discharge from a 10-year frequency, 24-

hour duration storm. Freeboard shall be not less than 0.3 ft.

Diversions designed to protect areas such as urban areas, buildings, roads, and animal waste management systems shall have a minimum capacity for the peak discharge from a storm frequency consistent with the hazard involved but not less than a 25-year frequency, 24-hour duration storm. Freeboard *should* be not less than *0.5* ft.

Capacity of diversions shall be calculated by one of the following methods:

1. *For nonvegetated channels use Manning's formula with an "n" value of 0.06 or the value in the supplement to the National Engineering Handbook Series, Part 650, Engineering Field Handbook (EFH), Chapter 9 "Non-vegetated diversion channel design aid."*
2. *For grass-lined channels use a "B" retardance and :*
   a. *The design tables and supplements in the (EFH), Chapter 9, or*
   b. *Software approved by the Common Computing Environment (CCE) such as the Ohio Engineering Programs, or*
   c. *SCS TP-61, "Handbook of Channel Design for Soil and Water Conservation," or*
   d. *Agricultural Research Service (ARS) Agricultural Handbook 657, "Stability Design of Grass-Lined Open Channels."*
3. *For channels planted entirely to sugarcane or pineapple use Manning's formula with an "n" value of 0.12.*

Design depth is the channel storm flow depth plus freeboard, *as* required.

Cross Section

The channel may be parabolic, V-shaped, or trapezoidal. The diversion shall be designed to have stable side slopes. *For vegetated and non-vegetated diversions, side slopes should not be steeper than a ratio of two horizontal to one vertical. Rock diversions may have steeper side slopes.*

The ridge shall have a minimum top width of 4 feet at the design depth. The ridge height shall include an adequate settlement factor.

The ridge top width may be 3 feet at the design depth for diversions with less than 10 acres drainage area above cropland, pastureland, or woodland.

The top of the constructed ridge at any point shall not be lower than the design depth plus *ten (10) percent* overfill for settlement.

The design depth at culvert crossings shall be the culvert headwater depth for the design storm plus freeboard.

Channel Grade and Velocity

Channel grades may be uniform or variable. Channel velocity shall not exceed that considered non-erosive for the soil and planned vegetation or lining. *Table 1 shall be used to determine maximum permissible channel velocities.*

TABLE 1
MAXIMUM DIVERSION VELOCITIES
(fps)

	Soil Erosion Resistance Group			
Type of Cover	*I*	*II*	*III*	*IV*
Grass (0% to 5% slopes)	*10.0*	*9.0*	*8.0*	*6.0*
Nonvegetated or Planted to Sugarcane or Pineapple	*5.5*	*4.5*	*3.5*	*2.5*

Stone waterways with rock material 3 inches to 10 inches shall not exceed velocities of 6 ft/sec. Higher velocities may be used with the approval of an engineer.

Rock sizes may be determined using Part 650, EFH, Chapter 7, Exhibit 7-6.

Soil erosion resistance groups can be found in the Part 650, EFH, Chapter 2.

Design velocity shall be calculated by one of the following methods:

1. *For nonvegetated channels or channels planted to sugarcane or pineapple use Manning's formula with an "n" value of 0.03 or the value in the supplement to the Part 650, EFH, Chapter 9 "Non-vegetated diversion channel design aid."*
2. *For grass-lined channels use a "D" retardance and:*
    a. *The design tables and supplements in Part 650, EFH, Chapter 9, or*
    b. *Software approved by the CCE such as the Ohio Engineering Programs, or*
    c. *SCS-TP-61, or*
    d. *Agricultural Research Service (ARS) Agricultural Handbook 657.*
3. *Stone waterways that are smooth and uniform, use Manning's formula with an "n" value of 0.03. Jagged and irregular stone channels use Manning's "n" value of 0.04.*

Location

The outlet conditions, topography, land use, cultural operations, cultural resources, and soil type shall determine the location of the diversion.

Protection Against Sedimentation

Diversions normally should not be used below high sediment producing areas. When they are, a practice or combination of practices needed to prevent damaging accumulations of sediment in the channel shall be installed. This may include practices such as land treatment erosion control practices, cultural or tillage practices, vegetated filter strip, or structural measures. Install practices in conjunction with or before the diversion construction.

If movement of sediment into the channel is a problem, the design shall include extra capacity for sediment or periodic removal as outlined in the operation and maintenance plan.

Outlets

Each diversion must have a safe and stable outlet with adequate capacity. The outlet may be a grassed waterway, a lined waterway, a vegetated or paved area, a grade stabilization structure, an underground outlet, a stable watercourse, a sediment basin, or a combination of these practices. The outlet must convey runoff to a point where outflow will not cause damage.

Vegetative outlets shall be installed and established before diversion construction to insure establishment of vegetative cover in the outlet channel.

Underground outlets consist of an inlet and underground conduit. The release rate of an under ground outlet, when combined with storage, shall be such that the design storm runoff will not overtop the diversion ridge. *The inlet and underground conduit shall meet the requirements in the standard and specification for Underground Outlet (Code 620).*

The design depth of the water surface in the diversion shall not be lower than the design elevation of the water surface in the outlet at their junction when both are operating at design flow.

Vegetation

Disturbed areas that are not to be cultivated shall be seeded as soon as practicable after construction. G*rassed lined diversions may be vegetated as follows:*

1. *The entire cross section established to a recommended grass species.*

2. *The entire cross section established to natural vegetation. This method will be limited to locations receiving more than 30 inches of annual rainfall, on diversion slopes less than 10 percent, and where there is a proven ability for desirable natural vegetation to establish itself.*
3. *A combination channel with the middle one-half of the cross section established to a recommended grass species and the remaining section planted in sugarcane or pineapple. For trapezoidal sections, the entire bottom width shall be established to a recommended grass species.*
4. *The entire channel or a combination channel with the center of the cross section lined with rock. For trapezoidal sections, the entire bottom width shall be rocked. The side slopes may be planted with the recommended grass species, natural grass, or nonvegetated. A gravel bedding or filter fabric should be placed under the rock to prevent erosion of the underlying soil.*
5. *The entire diversion cross section planted in sugarcane or pineapple.*

The recommended grass species are shown in Table 2.

TABLE 2
Recommended Grasses 1/

Scientific Name	*Common Name*
Axonopus affinis	carpetgrass
Cynodon dactylon	*bermudagrass 2/*
Pennisetum clandestinum cv. Whittet	kikuyugrass
Digitaria decumbens cv. Pangola Transvala	digitgrass
Eremochloa ophiuroides	centipedegrass
Paspalum hieronymii cv. Tropic Lalo	paspalum
Paspalum notatum cv. Pensacola Wilmington	bahiagrass
Stenotaphrum secundatum	st.augustinegrass

1/ This list is not all-inclusive. Other species may be used based on prescriptions by qualified NRCS technical specialists.

2/ All commercially available cultivars (cv).

Recommended grasses shall be established in conformance with Critical Area Planting (Code 342). Diversions to be established by natural vegetation shall be fertilized in accordance with soil test recommendations immediately after construction. Refer to the Nutrient Management (Code 590) standard and specification when working with the land user on a fertilizer program.

Lining

If the soils or climatic conditions preclude the use of vegetation for erosion protection, non-vegetative linings such as gravel, rock riprap, cellular block, or other approved manufactured lining systems may be used.

CONSIDERATIONS

A diversion in a cultivated field should be aligned and spaced from other structures or practices to permit use of modern farming

equipment. The side slope lengths should sized to fit equipment widths when cropped.

At non-cropland sites, consider planting native vegetation in areas disturbed due to construction.

Maximize wetland functions and values with the diversion design. Minimize adverse effects to existing functions and values. Diversion of upland water to prevent entry into a wetland may convert a wetland by changing the hydrology. Any construction activities should minimize disturbance to wildlife habitat. Opportunities should be explored to restore and improve wildlife habitat, including habitat for threatened, endangered, and other species of concern.

On landforms where archeological sites are likely to occur, use techniques to maximize identification of such sites prior to planning, design, and construction.

PLANS AND SPECIFICATIONS

Plans and specification for installing diversions shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

Plans (design drawings) should include:

a. length,

b. width,

c. depth,

d. side slopes, and

e. profile showing the slope of channel.

f. Particle sizes should be included for rock lined diversions.

For vegetated diversions, plans should specify:

a. grass species,

b. recommended planting time and methods,

c. fertilizer recommendations, and

d. if irrigation will be needed for the establishment or maintenance of the vegetative cover.

OPERATION AND MAINTENANCE

The operation and maintenance *guide for diversion shall be provided to and reviewed with the landowner.*